Absolute Calibration of a CW-FM LADAR Length Metrology System, Montana State University, Bozeman - $138,000 Awarded
MSU-Spectrum Lab and Bridger Photonics aim to develop calibration systems and methods for their jointly developed laser based distance measuring system. This laser system can precisely measure large distances to less than a micron (width of a human hair), and has great potential for use in industrial applications that require precise measurements. For many applications measurements must be accurate to 1 part per million, which will require very precise calibrations of the laser system. The proposed calibration method is based on optical spectroscopy of molecular gases, which provides an absolute scale to calibrate the laser frequency sweeps at the core of the laser measurement system. The resulting accuracy of the system will be verified by tests at the National Institute of Standards and Technology (NIST) in Boulder, CO, which is responsible for measurement standards within the United States. Successful completion of this project will further MSU-Spectrum Labs interest in precision laser measurements, and will improve the commercialization efforts by Bridger Photonics by ensuring their systems are accurate.

Development of a Commercial Production System for Protein Cage Nanoparticles (PCNs) for Immunotherapeutic Applications, Montana State University, Bozeman - $160,000 Awarded
Nanoscale protein cages (PCNs) have been developed by MSU researchers and have shown to provide highly effective protection against viruses including influenza, RSV and SARS. The goal of this research project is to develop commercially relevant production systems for PCNs, the first step in a long-term goal of building a Montana-based biotech company based on PCN technology. MBRCT funds will be used to develop PCN production systems for FDA approval and industry acceptable protocols of production and to produce PCNs for the next generation of efficacy and safety studies.

Development of New Antibacterial Dendrimers, Montana State University, Bozeman - $64,200 Awarded
The goal of this proposal is to develop an antimicrobial agent that addresses the increasing problem of bacterial resistance to currently available antibacterial agents. This antimicrobial agent falls into a category of antimicrobials called the quaternary ammonium antimicrobials (QAAs), which have applications including agricultural pesticide control and disinfection, wood preservation, water treatment, household products, medical disinfectants, and antimicrobial topical treatments. Since this agent provides a mechanism for complete cell disruption, it is highly unlikely that microorganisms will be able to adapt to such a catastrophic event. Thus, microorganisms will be much less likely to develop resistance to this antimicrobial agent than to currently available compounds. This grant provides funding for larger scale synthesis and

advanced toxicity studies with the new QAAs. Commercialization through out-licensure of the technology via the Montana State University Technology Transfer Office is planned.

Enhancement of Applied Research in Biomedicine, University of Montana, Missoula - $197,066 Awarded

This project builds on an applied/translational biomedical research enterprise in the study and treatment of diseases of the nervous system. This effort is intended to directly promote interactions between university researchers, hospital clinicians and private sector biotech/biomedical companies in a manner that positively impacts the state's economy. The project leverages grant support provided for basic neuroscience research by the NIH to the University of Montana's Center of Biomedical Research Excellence (COBRE) in Structural and Functional Neuroscience (≈ $10 million from 2005-2010). Scientists participating include those affiliated with the Center, as well as those in private sector research entities, such as St. Patrick Hospital and Health Sciences Center and emerging Biotech companies in Montana. An additional collaborative effort is now in place involving faculty and students from the UM School of Business Administration. A strong emphasis is placed on the development of novel diagnostics, devices and/or therapeutic agents related to the treatment of brain injury or disease. In the past few years, these efforts have led to the development of numerous patents and the establishment of four biotech spin-off companies in Montana. The award will be used to support a number of endeavors, including: seed projects to development, refinement, and protection of intellectual property that will be commercialized in the private sector, the development of incubator space for SBIR projects, the maintenance of high-tech, high-cost shared instrumentation as a statewide research resource, the training of students, and the continued promotion of collaborative projects between Center researchers and biotech/biomedical companies in Montana.

Novel Controlled Release Fertilizer Materials Derived from Renewable and Environmentally Degradable Polymers, Rivertop Renewables, Inc., Missoula - $150,125 Awarded

Rivertop Renewables will use grant funds to develop advanced plant fertilizers capable of delivering nutrients in a controlled manner. These advanced fertilizers will help address economic and environmental concerns related to the use of conventional fertilizers. The target fertilizers will consist of conventional fertilizer components encapsulated in a biodegradable polymer matrix. Upon application into the soil, the matrix will degrade, releasing the entrained fertilizer and ultimately serving as nutritive nitrogen source. Building upon technology developed at The University of Montana and under exclusive license to Rivertop Renewables, a versatile method will be developed for cost efficient production of a variety of polymer products. The use of different polymer matrices will allow tailoring of the degradation rates and fertilizer release to match different climate, soil, and crop demands.

Hyperspectral Sensor for Large-Area Monitoring of Carbon-Dioxide Reservoirs and Pipelines, Resonon, Inc., Bozeman - $149,985 Awarded

Resonon is working with Montana State University to develop a system for indirectly

detecting carbon-dioxide leaks from underground pipelines and reservoirs that may occur from carbon sequestration activities. The basis of the technology is that underground sources of carbon-dioxide leaking to the surface cause plant stress. Resonon's imaging technology, which can be deployed on manned or unmanned aircraft, is highly sensitive to changes in how plants reflect sunlight when they are stressed. Thus, the system is basically looking for sick plants, which happen to be good indicators of underground carbon-dioxide leaks. Because other factors can also stress plants, such as leaks from methane pipelines, chemical spills, pest infestations, there is a wide range of potential applications. During this project, Resonon will use MBRCT funds to address critical commercial issues associated with the technology such as repeatability, system calibration, ease of use, and deployment procedures.

Clinical Trials of a Lypolytic Compound, All American Pharmaceutical, Inc., Billings - $10,000 Awarded

All American Pharmaceutical has a proven track record of bringing products to the national and international market by its ability to combine research expertise, in-house production, and marketing experience. The company has completed research and formulation of a natural lypolytic compound that has the potential to lower cholesterol and triglyceride levels. The compound meets the criteria of a non-prescription, over-the-counter dietary supplement. The next step, and the focus of this project, is to determine the mechanism of antilipidemic action and confirm the compound's efficacy in human studies.

Structured Nanophase Catalysts, EIP International, Missoula - $ 110,930 Awarded

EIP International, in collaboration with MSU, is developing advanced catalysts for the conversion of coal to hydrogen. Hydrogen is considered one of the more promising fuels of the future and Montana is well placed to capitalize on this market given its extensive coal reserves. EIP's patent protected technology produces nanophase structures, with three-dimensional features (rather than the commonly available two dimensions) favorable for catalysts used in coal to hydrogen conversion. The produced catalysts will have performance advantages due to their unique structures, chemistry and extremely small sizes. Catalysts have many commercial applications in a multi-billion dollar market.

Fluorescent Reporters for Cre Recombinase: New Tools for Manipulating Animal Genomes to Study the Genetic Factors of Disease, Montana Molecular, Bozeman - $99,809 Awarded

Montana Molecular will develop a new generation of fluorescent molecules for detecting Cre recombinase. Cre recombinase is widely used in genetic research to manipulate genes and create genetic models of human diseases. The project will be done in collaboration with the Molecular Motion Laboratory, at Montana State University. The company plans to launch two new products in 2010 that will result from this project. *Cre Stoplight 2.0*™ will be a new and improved reporter that is sensitive enough to detect the activity of a single Cre enzyme within a living cell, and will produce a strong enough fluorescent signal for cell purification and physiology. The new product will also be updated with better fluorescent proteins that are brighter and exhibit fluorescence faster than those in

the original Cre reporter. *Cre Shine*™ will produce bright fluorescence at the cell membrane of living cells, and will be suitable for double-labeling, purification and physiological recordings.

Study of How Morphology and Physiology of Native Wildflower Seed Affects its Harvestability in Particular by the Arbuckle Native Seedster, Native Seedsters, Inc., Billings - $87,722 Awarded
This grant will provide Native Seedsters, Inc. (NSI) funds to study the effects of the Morphology and Physiology of Native Wildflower Seed on harvestability with focus on the Arbuckle Native Seedster. NSI will analyze and describe the seed morphology of native wildflowers drawing on botanists and other plant scientists. Initially, preliminary results will be gathered from flora throughout the U.S., describing harvest-related morphological features. Description and analysis will be followed by field validation tests with the Native Seedster on a number of species of wildflowers. Upon conclusion of the project, a report will be published on how the seed morphology of individual native wildflower species affects their harvestability.

Nutrient Management for the Optimization of Biofuels Production in a Proprietary CTW Energy Algal Photobioreactor, CTW Energy, Bozeman - $241,398 Awarded
This CTW Energy/Montana State University-Bozeman project seeks to identify and optimize the nutrient conditions that lead to the highest lipid content and/or growth rate in microalgae and to implement this nutrient management strategy in the growth of algae in the Modular-CTW Energy Algal Photobioreactor System (M-CAPS). The implementation of the proposed research has significant commercialization potential as the optimized algal cultures can then be used for the production of biofuels as an integrated part of the CTW Energy Wastewater Treatment process. The optimization of the nutrient conditions with the M-CAPS has the potential to make biodiesel production from algal lipids more cost-effective.

A New Cost-Effective, Non-Invasive, Geophysical Methodology for Exploration and Development of Geothermal Resources in Montana, Montana Tech, Butte - $93,130 Awarded
Untapped geothermal energy hidden deep in the earth may soon be easier to find, thanks to innovative new exploration tools being developed by Gradient Geothermal Inc., Missoula, and Montana Tech, Butte. New exploration tools developed by this project will combine ground temperature measurements with electrical conductivity measurements. Advanced computer software will then analyze this information to locate currently hidden geothermal energy resources. The natural hot water and steam that is found could then be tapped to generate electricity. Commercialization of these exploration tools could mean a global market with geothermal energy development companies.

High Efficiency Hybrid Solar Power System—Producing Electricity and Hot Water Simultaneously, Rural Community Innovations, Bozeman - $150,000 Awarded
The goal of this project is to develop prototype hybrid solar power panels that simultaneously produce electricity and hot water. The main barrier for the widespread

adoption of solar electricity generating systems currently is the relatively high cost of photovoltaic solar cells. The number and cost of solar cells needed for a given electrical power output will be reduced by using a light-concentrator system. The design incorporates efficient heat transfer to cool the photocells and simultaneously generate hot water. The system can drive hot water-based heating systems in buildings and green houses and can be adapted to forced air heating systems by adding a water-air heat exchanger. The new system will work well with the most reliable first generation photovoltaic cells and can accommodate new developments in photovoltaic solar cells, as they become available.

Metallic Nano Particle Filter to Remove Mercury from Coal Fired Power Plant Flue Gas, Montana Tech, Butte - $90,499 Awarded

The goal of this research is to develop a marketable and cost effective device to remove mercury vapor from flue gas including that emitted from coal fired power plants. The toxic effects of mercury are well recognized and controlling mercury emissions from coal fired power plants has been a major challenge. Coal and coal fired power generation are major contributors to Montana's economy and industrial growth, and the proposed nano metallic mercury control device will directly help the performance and future of these industries. Montana Tech has successfully developed, tested, and patented a metallic mercury filter that can remove vapor form of mercury from gas streams. However, these metallic filters are expensive because of the high cost of metals that is used to fabricate them. To address this problem, three different ceramic cylinder substrates will be tested from which the best performing filter will be selected for additional tests. The used filter materials will be evaluated for their mercury release characteristics, and for their reuse back into the system for mercury removal. Montana Tech will explore the potential to manufacture this filter in Montana.

Development of a Field-Portable Biodetector, Resodyn Corporation, Butte - $379,532 Awarded

Resodyn Corporation is undertaking the development of a field-portable sensing system that can test fluidic samples for the presence of pathogens. The sensor makes use of a highly sensitive optical detection technique known as Surface Plasmon Resonance (SPR) to detect small quantities of present hazardous substances. This will make possible the rapid, reliable detection and quantification of the analytes of interest. Preliminary efforts will focus in the development of food safety applications to detect the presence of more common pathogens, including salmonella, E. coli, and botulism. A field-portable instrument, such as the proposed design, enables the user to perform testing of substances on site. This system could become a tool for agencies to monitor, or producers to self-regulate, for the presence of pathogens, and eventually be capable of identifying plant and animal disease, toxic compounds, and other pathogens of concern.

MADA SFRJ (Solid Fueled Ramjets) Technology Development and Testing, Montana Aerospace Development Association, Butte - $106,000 Awarded

The Montana Aerospace Development Association (MADA), in conjunction with its partner, SPG Inc., will develop a Solid Fuel Ramjet test-bed at the Butte AeroTec Facility. This project involves reassembling test hardware previously moved to

Butte from Mojave, California, and providing Butte AeroTec with a new and unique capability for testing this advanced propulsion technology. Due to their simple design, Solid Fuel Ramjets possess significant technological advantages over turbojets or rockets for high-speed flight vehicles, and this new test facility will place Montana in a lead role in the development of the technology. SPG, a Stanford University spin-off company, is also partnering with MADA to test hybrid rocket technology at Butte AeroTec. The project could result in Butte AeroTec's customers eventually setting up operations in Montana.

Bio-Agtive™ Emission Technology: Turning Fuels into Fertilizer, Montana State University Northern, Havre - $119,420 Awarded

MSU-Northern Bio-Energy Innovation and Testing Center, in partnership with BioAgtive™ Montana, LLC, N/C Quest Inc. and other partners, were funded to research the Bio-Agtive™ Emissions Technology, which is a patented method for introducing cooled exhaust from diesel engines into the soil during the direct seeding of agricultural crops. Preliminary experiments conducted by Bio-Agtive™ Montana, located in Chester, have shown that peas grown with emissions tend to have visibly greater root systems and better early establishment, than peas not seeded with engine emissions. The research focus will be to accurately evaluate the Bio-Agtive™ system in terms of agriculture, environment and sustainability by analyzing the chemical composition of the exhaust from various fuels. The research will study emissions composition using different biodiesel fuels, effects on plant growth and effects on soil microorganisms. The research will support development and improvement of the technology that will be manufactured in Chester for distribution in the U.S., and possibility for export to other countries that are using the System including Japan, South Africa, England and Australia.

Continuation of Collaborative Research on Innovative Fluorescence Lifetime Spectrometers, Fluorescence Innovations, Inc., Bozeman - $200,000 Awarded

Fluorescence Innovations has developed a new method for measuring fluorescence decay data that is 100 times faster than current methods and intend to incorporate this technology into a broad product line of innovative fluorescence spectrometers. More than $400,000 in product sales has already been obtained as a result of previous MBRCT funding. This project will allow expanding the scope of scientific studies necessary to fully establish the technology's value and conclusively demonstrate its superiority to competing fluorescence lifetime technologies. The data thus generated will be used in scientific publications, application notes, marketing materials, and grant proposals. In sum, the MBRCT funding will play a key role in accelerating commercialization and further expansion of the product line.

Measurement of Optical Output of High-Power Laser Diodes, ILX Lightwave, Bozeman - $107,885 Awarded

This project will develop and commercialize the technology for high accuracy measurement of the light output of high power diode lasers. Due to their high efficiency, high reliability, and compact size, high power diode lasers are finding increasing

applications in industrial, medical, military, and aerospace products. Manufacturers and users of these unique lasers need a more accurate method to measure their light output power. ILX Lightwave in collaboration with Montana State University will develop the technology for high accuracy optical power measurement and employ this technology in the development of a series of new products which will be marketed by ILX Lightwave.

Commercial Introduction of Barley Protein Concentrate in Aquaculture Markets, Montana Microbial Products, Butte - $118,900 Awarded

Montana Microbial Products (MMP) has developed a process to co-produce high quality protein concentrate and ethanol from barley. The barley protein concentrate (BPC) will replace fishmeal now used as the protein ingredient in farmed fish, poultry and swine diets. The initial market for BPC is as a replacement for fishmeal in farmed trout diets. This project provides funding to perform the tests necessary in order to obtain purchase commitments from big customers. It will also expand fish feeding trials to species of fish other than trout. The ethanol will be marketed as an octane booster in gasoline. The use of ethanol as a transportation fuel is growing and will continue to grow because of requirements found in the Renewable Fuel Standard. The high value co-product, BPC, makes ethanol production profitable at lower ethanol prices than are profitable for a conventional corn ethanol plant.

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